CLAIMS

What is claimed is:

1. An optical waveguide to amplify optical signals in fiber-optic communications, the optical waveguide comprising:

at least one gain portion that provides a gain to one or more wavelengths in an optical signal; and

at least one gain equalization filter portion that is optically coupled to the at least one gain portion, wherein the at least one gain equalization filter portion selectively attenuates the one or more wavelengths such that the gain of each wavelength in the optical signal is substantially equal.

2. The optical waveguide of claim 1, wherein the gain equalization filter portion is adapted to pre-compensate the optical signal for gain non-uniformities before receiving gain from the at least one gain portion.

3. The optical waveguide of claim 1, wherein the gain equalization filter portion is adapted to compensate the optical signal for gain-non uniformities after receiving gain from the at least one gain portion.

4. The optical waveguide of claim 1, wherein the at least one gain portion and the at least one gain equalization filter portion are disposed in at least one of a single mode fiber, a multimode fiber and a double clad fiber.

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5. The optical waveguide of claim 1, wherein the at least one gain equalization filter portion comprises a UV written Bragg grating in the optical waveguide.

6. The optical waveguide of claim 1, wherein the at least one gain equalization filter portion comprises a mechanical perturbation of the optical waveguide.

7. The optical waveguide of claim 1, wherein the at least one gain equalization filter portion comprises an electrically induced grating.

8. The optical waveguide of claim 1, wherein the at least one gain equalization filter portion comprises an etched grating.

9. The optical waveguide of claim 1, wherein the at least one gain equalization filter portion further comprises a series of Bragg gratings at different Bragg wavelengths.

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10. The optical waveguide of claim 1, wherein the optical waveguide further comprises an inside core surrounded by a cladding, wherein the at least one gain equalization filter portion is formed in at least one of the inside core and the cladding.

11. The optical waveguide of claim 1, further comprising a doped portion that is doped with at least one of Erbium, Yb, Sm and Tm, wherein the doped portion

includes at least one of the at least one gain portion and the at least one gain equalization filter portion.

12. The optical waveguide of claim 1, wherein the at least one gain equalization filter portion includes a plurality of discrete segments.

13. The optical waveguide of claim 1, wherein the at least one gain equalization filter portion includes a plurality of Gaussian shaped filters.

14. The optical waveguide of claim 1, further comprising a length having a standard value.

15. The optical waveguide of claim 1 wherein the at least one gain equalization filter portion selectively attenuates the one or more wavelengths such the gain of each wavelength in the optical signal is within 2dB of each other wavelength in the optical signal.

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16. An optical waveguide to amplify optical signals in fiber-optic communications, the optical waveguide comprising:

an optical fiber having a length, wherein the optical fiber includes:

a gain section that provides each wavelength in an optical signal with a different gain; and

a gain equalization filter that attenuates some of the wavelengths in the optical signal such that each wavelength in the optical signal has substantially the same gain.

17. The optical waveguide of claim 16, wherein the gain equalization filter is adapted to pre-compensate the optical signal for gain non-uniformities before receiving gain from the gain section.

18. The optical waveguide of claim 16, wherein the gain equalization filter is adapted to compensate the optical signal for gain non-uniformities after receiving gain from the gain section.

19. The optical waveguide of claim 16, wherein the optical fiber is at least one of a single mode fiber, a multimode fiber and a double clad fiber.

20. The optical waveguide of claim 16, wherein the gain equalization filter comprises a UV written Bragg grating in the optical waveguide.

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21. The optical waveguide of claim 16, wherein the gain equalization filter comprises a mechanical perturbation of the optical waveguide.

22. The optical waveguide of claim 16, wherein the gain equalization filter comprises an electrically induced grating.

23. The optical waveguide of claim 16, wherein the gain equalization filter comprises an etched grating.

24. The optical waveguide of claim 16, wherein the gain equalization filter comprises a series of Bragg gratings at different Bragg wavelengths.

25. The optical waveguide of claim 16, wherein the optical waveguide further comprises an inside core surrounded by a cladding, wherein the at least one gain equalization filter portion is formed in at least one of the inside core and the cladding.

26. The optical waveguide of claim 16, further comprising a doped portion that is doped with at least one of Erbium, Yb, Sm and Tm, wherein the doped portion includes at least one of the gain section and the gain equalization filter.

27. The optical waveguide of claim 16, wherein the gain equalization filter includes a plurality of discrete segments.

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28. The optical waveguide of claim 16, wherein the gain equalization filter includes a plurality of Gaussian shaped filters.

29. The optical waveguide of claim 16, the optical fiber comprising a length having a standard value.

30. The optical waveguide of claim 16, wherein the gain equalization filter selectively attenuates the some of the wavelengths such the gain of each wavelength in the optical signal is within 2dB of each other wavelength in the optical signal.

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31. An optical amplifier comprising:

an optical waveguide, the optical waveguide comprising:

at least one gain section that provides wavelength dependent gain to each wavelength in an optical signal; and

a gain equalization filter that provides selective attenuation based on each wavelength in the optical signal to balance gain provided by the at least one gain section across each wavelength the in the optical signal;

a pump laser coupled to the optical waveguide, the pump laser configured to pump a pumping signal onto the optical waveguide for amplifying an optical signal input into the optical waveguide; and

a controller coupled to the pump laser configured to control the power of the pumping signal pumped onto the optical waveguide.

32. The optical amplifier of claim 31, wherein the optical waveguide is doped with at least one of Erbium, Yb, Sm and Tm.

33. The optical amplifier of claim 31, the optical waveguide comprising at least one of a single mode fiber, a multimode fiber, and a double clad fiber.

34. The optical amplifier of claim 31, the gain equalization filter comprising a UV written Bragg grating in the optical waveguide.

35. The optical amplifier of claim 31, the gain equalization filter comprising a mechanical perturbation of the optical waveguide.

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36. The optical amplifier of claim 31, the gain equalization filter comprising an electrically induced grating.

37. The optical amplifier of claim 31, the gain equalization filter comprising an etched grating.

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